



Cordell Bank National Marine Sanctuary CRUISE REPORT

CRUISE DATES: SEPTEMBER 22 – OCTOBER 3, 2002

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
National Marine Sanctuary Program



NOAA Ocean Service

Cordell Bank National Marine Sanctuary

P.O. Box 159

Olema, CA 94950

tel: 415 663-0314

fax: 415 663-0315

CRUISE REPORT

VESSEL: VELERO IV / DELTA SUBMERSIBLE

CRUISE DATES: SEPTEMBER 22 – OCTOBER 3, 2002

**PROJECT: CORDELL BANK HABITAT
CHARACTERIZATION AND BIOLOGICAL ASSESSMENTS**

OVERVIEW OF OPERATIONS:

Cordell Bank National Marine Sanctuary (CBNMS) contracted to conduct habitat characterization studies and biological assessments with the two person Delta submersible from September 22 to October 3, 2002. Working in cooperation with the R/V Velero IV and Delta personnel, scientists from the CBNMS, National Marine Fisheries Service Santa Cruz laboratory, California Department of Fish and Game, and Washington State University, the Sanctuary completed quantitative surveys of benthic habitats and associated biological resources within CBNMS. The majority of effort was focused on Cordell Bank between 50 and 100 meters (m), but effort was also directed at surveying the adjacent continental shelf (80-150m) and slope (180-350m). The presence of fishing gear was documented as part of the characterization effort.

ITINERARY

September 22 Mobilization: Dan Howard, Dale Roberts and Michael Carver arrived at 1000 and loaded sampling gear. Departed Army Corps of Engineers dock in Sausalito and headed for Cordell Bank 2300.

September 23 0530 at Cordell Bank and prepared for first dive. First dive 0800. Completed six dives in quadrants C4,C6,C8,D5,D7,D9 (Figure 1) over northern part of Cordell Bank. Departed for Drake's Bay anchorage 1610. On anchor at 1914. Skiff to Point Reyes National Seashore life boat station to pick up Mary Yoklavich and Linda Snook from the National Marine Fisheries Service (NMFS) laboratory in Santa Cruz.

September 24 Departed Drake's Bay 0418, arrived Cordell Bank 0712. Start dive operations 0730. Completed six dives in quadrants D3,E4,E6,E8,E10,F9 over mid-Bank. Departed for Drake's Bay 1645. Anchored 1930. Skiffed to life boat station to pick up Bob Lea from California Department of Fish and Game. September 25 Departed Drake's Bay 0338, arrived Cordell Bank 0659. Start dive 0725.

Completed four dives in quadrats D2,F3,H6,G6, two dives on slope and shelf and two on north/central part of Cordell Bank. Departed for Drake's Bay 1545. Anchored 1830. Skiff to lifeboat station to drop off Mary Yoklavich and Linda Snook.

September 26 Departed Drake's Bay 0255, arrived Cordell Bank 0700. Start dive 0730. Completed six dives in quadrants F7,F6,F6,F5,G9,H7 on southern part of Cordell Bank. Depart for Drake's Bay 1645. Anchored 1925. Skiff to lifeboat station to pick up Tara Anderson from NMFS lab in Santa Cruz and Noalani Puniwai from Washington State University.

September 27 Departed Drake's Bay 0250, arrived Cordell Bank 0700. Start dive 0736. Completed one dive in quadrant i7. Second dive was aborted at 0918 because of deteriorating weather. Anchor in Drake's Bay 1745. Skiff Bob Lea to shore.

September 28 Departed Drake's Bay 0305, arrived Cordell Bank 0710. Start dive 0730. Completed three dives in quadrants G6,G7,H9, middle and southern parts of Cordell Bank. Weather deteriorated. Departed for Drake's Bay. Anchored in Drake's Bay 1615. Three Orcas cruised past the Velero while anchored in Drake's Bay 2018. Orcas came into the lights, moseyed for a bit, and then swam off toward the fish dock.

September 29 Departed Drake's Bay 0310, arrive Cordell Bank 0710. Start dive 0730. Completed five dives in quadrants B5,C5,C4,B7,B10 north end of Cordell Bank. Anchored in Drake's Bay about 1830. Skiff to lifeboat station to pick up Tom Laidig from the NMFS laboratory in Santa Cruz.

September 30 Departed Drake's Bay 0300. 0400 turned around and went back in to Drake's Bay due to weather. No diving today. Skiff to drop off Tara Anderson.

October 1 Weather continued to deteriorate wind speed upward of 40knts. No diving.

October 2 Weather did not improved. No diving. Departed for Sausalito approximately 1000. Docked at Army Corps of Engineers 1300.

October 3 Completed demobilization 1030.

SCIENTIFIC GOALS AND OBJECTIVES

The objective of this cruise was to begin to develop a quantitative description of habitat types and biological resources on and around Cordell Bank. Temporal comparisons are planned using data collected during future surveys at Cordell Bank. Spatial comparisons are planned using data collected from nearby areas outside of the Sanctuary. Data will also be compared with information collected by other researchers using the Delta for similar work along the west coast of North America from Alaska to Southern California.

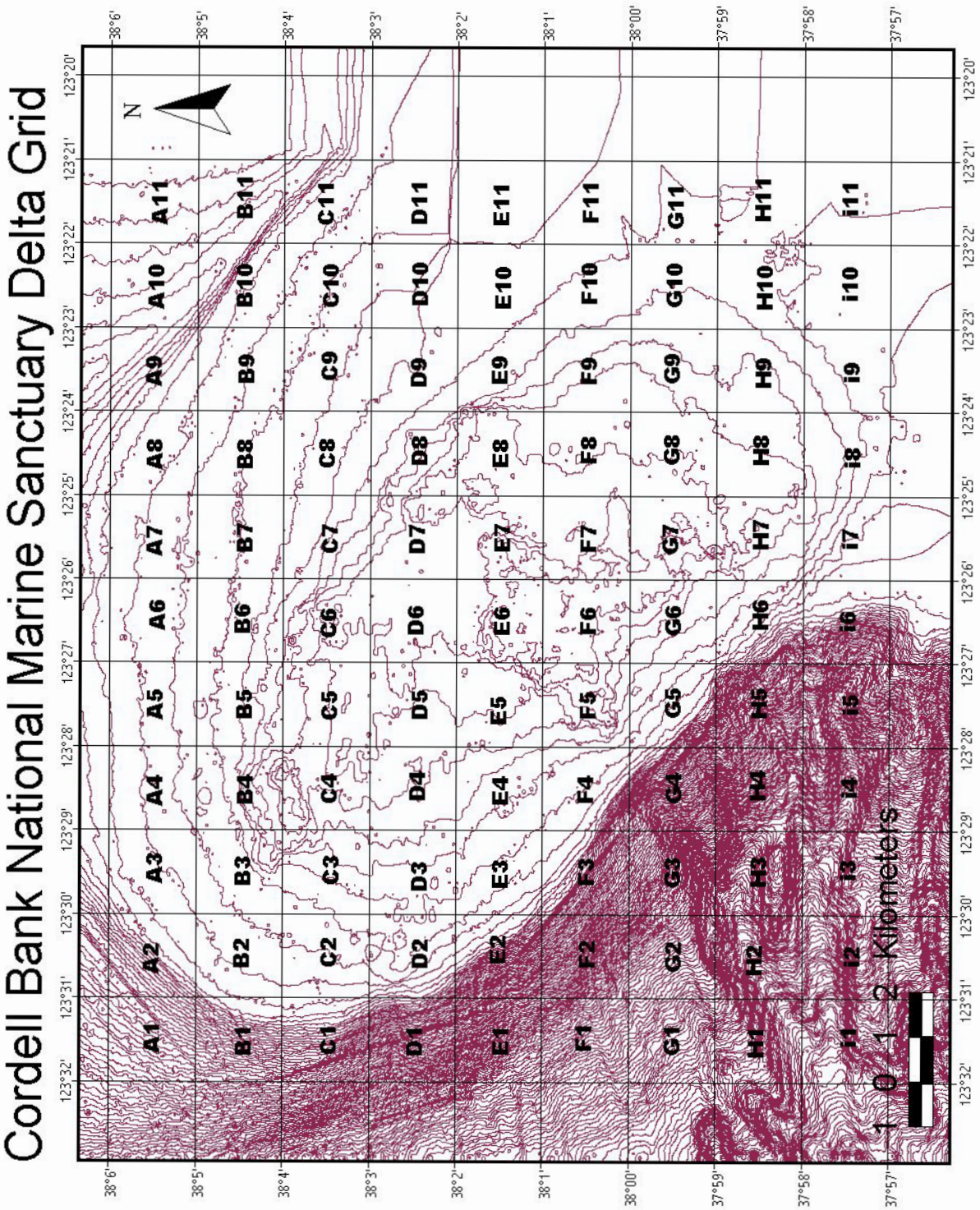
EDUCATION GOALS AND OBJECTIVES

Information and images can be incorporated into outreach and education materials to increase the awareness and appreciation for the habitats and resources protected by CBNMS.

METHODS

A sampling grid with 99 one nautical mile (nm) by 0.75nm blocks was laid on top of a Cordell Bank bathymetric map to spatially index Cordell Bank and the adjacent shelf and slope

(Figure1).



The sampling goal was to maximize spatial coverage of visual observations on and around Cordell Bank. Initially, dives were located every other block on the sampling grid starting in the northwest. After one pass, transects were completed in unsampled blocks. An attempt was made to stay at one depth during each transect. Multiple transects on steep continental slope dives were stratified by depth. Transects started deep and moved up the slope with each successive transect. Separate transects were conducted at 350m, 300m, and 250m on one slope dive. Survey methods followed the protocol described by Yoklavich et al., 2000. On each dive, two to three, fifteen minute transects were completed with a five minute interval between each transect. Observations were conducted from the starboard side viewing ports and transect width was held constant at 2m. Transect width was measured using a hand-held diver's sonar. A side looking color camera was mounted looking down at a 27° angle below the horizontal. Images were recorded with paired SONY mini DV decks on 80 minute tapes. Two identical copies were generated from each dive. The primary means of fish identification will be the audio record generated by the observer in the submersible. Post processing of video recordings will be used to verify fish identifications and sizes, enumerate and identify macro-invertebrates, classify bottom type (using the method of Stein et al., 1992) and measure transect distance. Rare fishes and invertebrates beyond the 2 meter limit were noted and will be part of the species list. No quantitative density estimates will be made for organisms outside the transect. Fish sizes were estimated using two lasers mounted 20 cm apart and oriented in the center of the video system's field of view. Following each dive, biologists reviewed their video tapes to check the quality of the audio and video record and the accuracy of species identification. A dive summary was completed by each observer after their dive. A second camera was mounted looking up and forward on the front of the submersible. This low light, black and white camera was used to collect information on the mid-water schooling fishes that are common at Cordell Bank. Observers estimated the number of individuals in a school, mean size, and the ratio of each species in mixed aggregations. Images were recorded with a SONY mini DV deck. Three dives were dedicated to invertebrate identification using the submersible's hand held digital camera. The location of the submersible was tracked with ORE Trackpoint 2. Position data were recorded with GeoPacific Solution's Winfrog Navigational software.

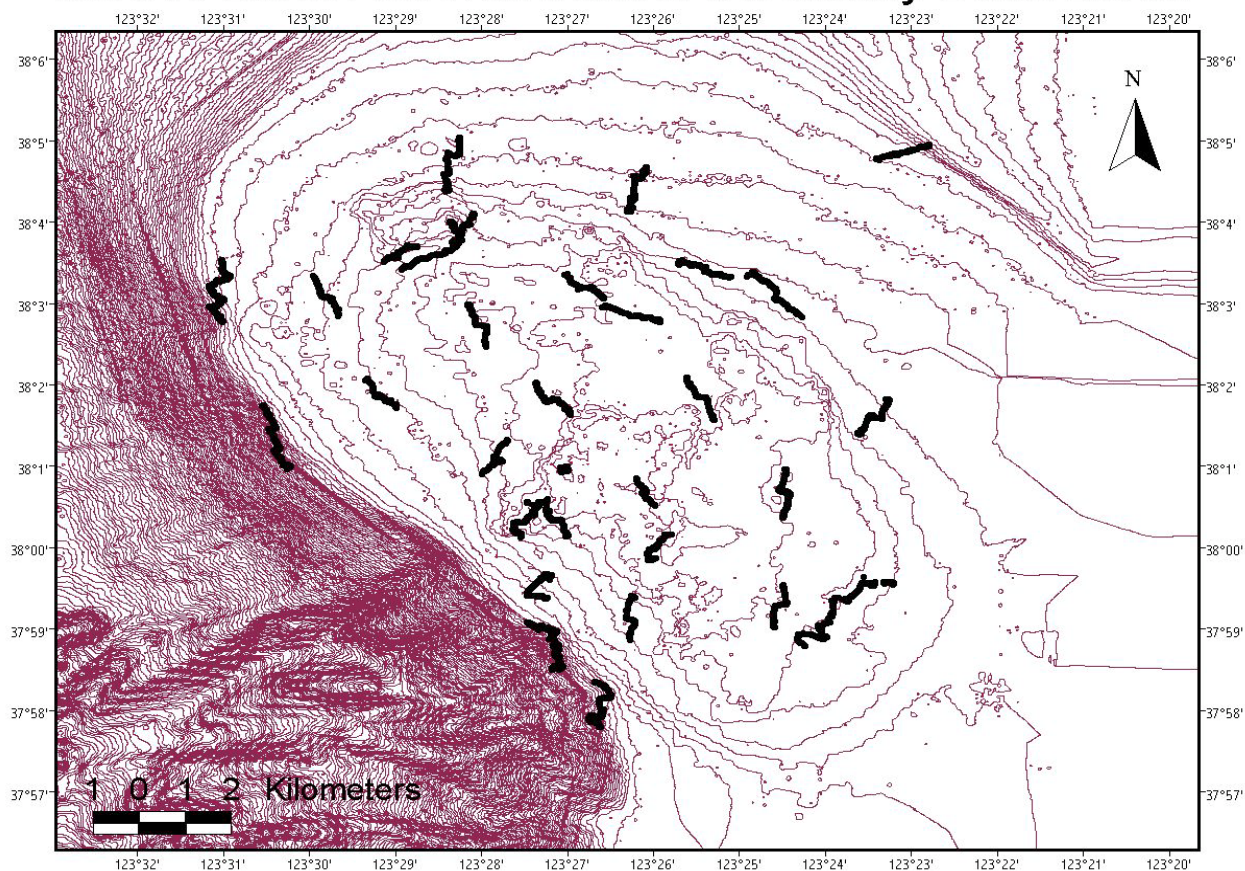
RESULTS

Thirty one dives were completed in five full days and parts of two additional days. Portions of two and three full dive days were lost due to bad weather. Sixty two, fifteen minute quantitative transects were completed during 28 dives. Three dives were dedicated to photo-documentation of invertebrates (Invert dives) on Cordell Bank and the surrounding continental shelf (Table 1). Ninety three digital tapes were recorded during the cruise. This includes two identical tapes per dive for the side looking camera and a one tape per dive for the forward looking camera.

Dive #	Delta #	Date (2002)	Pilot	Observer	Start Depth (meters)	Time on bottom (minutes)	# Transects Completed
1	5716	23-Sep	C. Ijames	D. Howard	108	68	2
2	5717	23-Sep	D. Slater	D. Roberts	75	41	2
3	5718	23-Sep	J. Lilly	M. Carver	105	39	2
4	5719	23-Sep	C. Ijames	D. Howard	105	41	2
5	5720	23-Sep	D. Slater	D. Roberts	70	38	2
6	5721	23-Sep	J. Lilly	M. Carver	80	38	2
7	5722	24-Sep	C. Ijames	L. Snook	118	39	2
8	5723	24-Sep	D. Slater	M. Yoklavich	114	38	2
9	5724	24-Sep	J. Lilly	L. Snook	52	44	2
10	5725	24-Sep	C. Ijames	M. Yoklavich	67	36	2
11	5726	24-Sep	D. Slater	D. Howard	106	41	2
12	5727	24-Sep	J. Lilly	D. Roberts	63	38	2
13	5728	25-Sep	C. Ijames.	B. Lea	365	69	3
14	5729	25-Sep	D. Slater	L. Snook	205	66	3
15	5730	25-Sep	J. Lilly	M. Yoklavich	295	64	3
16	5731	25-Sep	C. Ijames	B. Lea	118	46	1
17	5732	26-Sep	D. Slater	D. Howard	55	39	2
18	5733	26-Sep	J. Lilly	B. Lea	70	41	2
19	5734	26-Sep	C. Ijames	D. Roberts	102	40	2
20	5735	26-Sep	D. Slater	M. Carver	55	65	Invert dive
21	5736	26-Sep	J. Lilly	B. Lea	65	48	2
22	5737	26-Sep	C. Ijames	D. Howard	95	48	2
23	5738	27-Sep	D. Slater	B. Lea	200	58	3
24	5739	28-Sep	J. Lilly	T. Anderson	92	65	2
25	5740	28-Sep	C. Ijames	N. Puniwai	62	70	Invert dive
26	5741	28-Sep	D. Slater	D. Roberts	70	83	3
27	5742	29-Sep	J. Lilly	D. Howard	135	65	3
28	5743	29-Sep	C. Ijames	T. Anderson	90	42	2
29	5744	29-Sep	D. Slater	N. Puniwai	55	69	Invert dive
30	5745	29-Sep	J. Lilly	T. Anderson	135	88	3
31	5746	29-Sep	C. Ijames	D. Roberts	192	41	2
None		30-Sep					
None		1-Oct					

Visual observations and quadrants sampled provided broad spatial coverage on Cordell Bank and the adjacent continental shelf and slope (Figure 2). Starting dive depths ranged from 52 meters to 365 meters. On Cordell Bank, substrates varied from consolidated granite reef and pinnacles on the shallowest parts (40-50m), deeper boulder/ reef areas often cut by sand channels, boulder/sand areas, large expanses of current sculptured white sand (60-80m), and deep, high relief consolidated reef areas and large fractured rocks (80-120m). Granitic walls on the northern end of the Bank emerge abruptly from the soft sediments of the continental shelf. The transition from the shelf to Cordell Bank is more gradual in other areas. Sediment on the continental shelf ranges from coarse white sand on the eastern edge to a finer mud bottom on the northern and western sides. The continental slope is mud/clay substrate with vertical walls in some areas.

Cordell Bank National Marine Sanctuary Delta Dives



Invertebrate cover was over 100% on rock substrates shallower than 60 meters. Sponges, anemones, ascidians, hydroids, hydrocorals, and more motile forms create a dense carpet on the shallow reef. Invertebrate cover declines rapidly deeper than 60 m in most areas. An exception to this is on the northern end of Cordell Bank where thick benthic cover was observed down to 80 meters.

Many of the invertebrates on the shallower reef still need to be collected to confirm their identities (Appendix A). Echinoderms are the most visible macro-invertebrates deeper than 60 meters. Crinoids, sea stars, brittle stars and sea cucumbers were common on most transects. Eleven species of sea stars were identified. Several Giant Pacific Octopus (*Octopus dofleini*) were observed in the open on the reeftop. In addition to live animals, several bleached, dead (\approx 6-8) octopus were seen lying on the substrate. It is hypothesized that the dead octopus were adults that had spawned. Six hundred and ninety three digital still images were taken to document the benthic invertebrates.

On several occasions, visibility was obscured by thick layers of krill (*Euphausia pacifica*) as the submersible approached the substrate. This typically occurred on the west side of the Bank between 150 and 200m. The observer could usually transit for a distance and get out of the krill but the aggregations were patchy and sometimes would limit visibility several times during a dive. Though marine mammal surveys were not a part of this cruise, constant humpback and blue whale activity was observed on the surface.

Rockfishes (*Sebastes* spp.) were a major component of the fish fauna over Cordell Bank. Twenty seven of the 56 species identified during the cruise were rockfish (Appendix B). Mid-water schooling species were common over high relief pinnacles and rock ridges. These included yellowtail (*Sebastes flavidus*) and widow rockfish (*S. entomelas*) and, in the shallowest areas, blue rockfish (*S. mystinus*). In an effort to quantify mid-water species, a low light black and white camera was mounted on the front of the submersible. This video will be used in conjunction with the observers verbal record to estimate numbers for this species group.

Members of the subgenus Sebastomus were common closer to the substrate in many areas. This group consisted of the rosy (*S. rosaceus*), rosethorn (*S. helvomaculatus*), swordspine (*S. ensifer*) and starry rockfish (*S. constellatus*). The more general classification of Sebastomus was used when a species identification could not be determined. Several times, rosy rockfish were seen 4 to 5m off the bottom. In deeper reef areas, pygmy rockfish (*S. wilsoni*) were abundant. Often, two or three size classes were mixed in large aggregations extending three to four meters off the bottom. It was often difficult to estimate the number of fishes in these larger aggregations. Large individual bocaccio (*S. paucispinis*), canary (*S. pinniger*), yelloweye (*S. ruberrimus*) and vermilion rockfish (*S. miniatus*) were observed in deeper habitats around the Bank and in close proximity to isolated boulders on the shelf and slope. The consistent presence of larger rockfish around isolated rock outcrops is evidence that these isolated features provide important rockfish habitat. In addition, greenspotted rockfish (*S. chlorostictus*) were commonly found near rock outcrops on the shelf. The greenstriped rockfish (*S. elongatus*) was commonly seen on soft sediments adjacent to the Bank.

Flatfishes, primarily sanddabs (*Citharichthys* spp.) were the most visible fishes on the continental shelf east of Cordell Bank. In two instances, aggregations of smaller flatfishes were up in midwater 10m off the bottom. As the submersible approached, they dove for the substrate similar to the predation response of juvenile rockfishes on nearshore reefs. Similar to last year, juvenile flatfishes and ratfish (*Hydrolagus colliei*) egg cases were common in the troughs of sand waves on the continental shelf east of the Bank.

The slope fish community was depth and/or substrate dependent. Dr. Robert Lea, an ichthyologist with the California Department of Fish and Game, conducted stratified transects at three depths during one dive. The first transect was at 300m with a mixed substrate of silt and moderately coarse grained sand. Some species observed included ratfish (Hydrolagus coliei), longnose skate (Raja rhina), individual Pacific hake (Merluccius productus), bigfin eelpout (Lycodes cortezianus), Splitnose rockfish (S. diploproa), shortspine thornyhead (Sebastolobus alascanus), Threadfin sculpin (Icelinus filamentosus), Poachers (Xeneretmus spp.), Blacktail snailfish (Careproctus melanurus), Dover sole (Microstomus pacificus), English sole (Parophrys vetulus), Rex sole (Glyptocephelus zachirus), and Slender sole (Lyopsetta exilis).

The second transect was at 250m with the same substrate as the deep transect. Some species observed included hundreds of ratfish many small in the 200mm TL size range, California skate (Raja inornata) all small less than 200mm, Stripetail rockfish (S. saxicola), Poachers, Blacktail snailfish, Dover sole, and Rex sole.

The third transect was 200 m deep and had a finer substrate than the previous two transects consisting of shell hash and silt. Species observed included ratfish (not nearly as common as deeper transects), Stripetail rockfish, Greenstriped rockfish (S. elongatus), Dover sole, and Rex sole.

Mary Yoklavich with the NMFS laboratory in Santa Cruz conducted a second slope dive on a steep 35 - 40 degree slope of fine sediment over clay. The transect passed over vertical cliff areas that were heavily eroded, creating steep washes that were pocked with holes, crevices and caves. Many of the holes were occupied by hagfish (Eptatretus stoutii), rockfishes (Sebastes spp.), and spot prawns (Pandalus platycerus).

Entangled long lines on the bottom were seen nearly every dive (Figure 3). Long lines were the most common gear type seen, but old gill nets and trawl cables and netting were also observed. In one instance, several large Metridium anemones had settled and grown on the float line suspended in the water column indicating the gear had been there for several years.

Locations of fishing gear observed on Cordell Bank

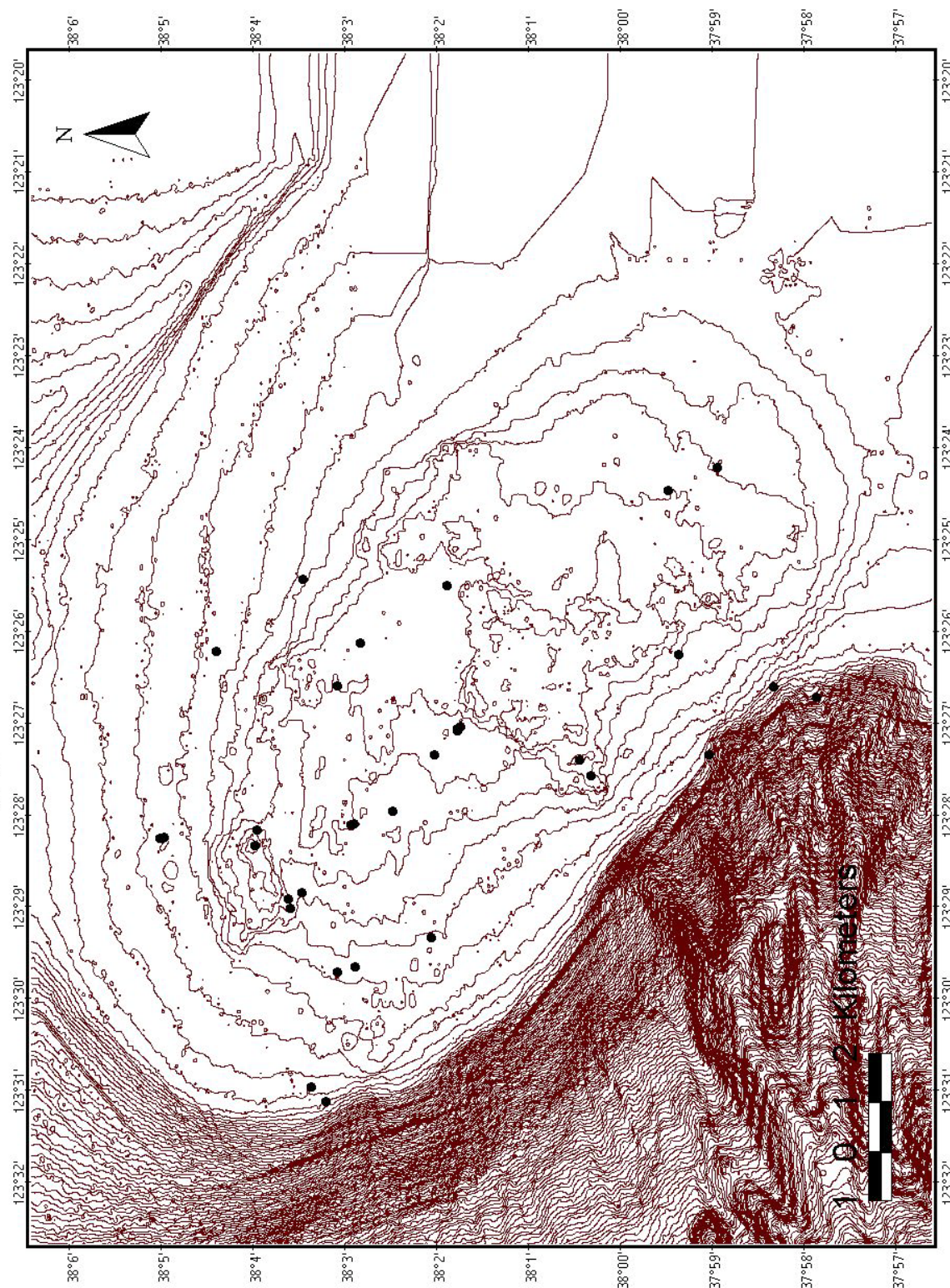


Figure 3. Locations of fishing gear observed on Cordell Bank.

Things we did not see:

Black rockfish (*S. melanops*) – a common rockfish on nearshore reefs with a similar early life history to many of the species observed on the Bank

Ebiotocids – except one pink surfperch (*Zalembius rosaceus*) over sand

Interesting Observations:

- On a continental shelf dive just east of the Bank (100 m deep), many ratfish egg cases were noted in the troughs of sand waves on the bottom. A subsequent dive on the continental slope (250m deep) noted hundreds of small ratfish around 200mm but no egg cases. The early life history of this species is not known. Larger individuals were common on Cordell Bank and the surrounding shelf and slope.

- At 2018 hrs on September 28, three killer whales (*Orcinus orca*) cruised by our vessel anchored in Drake's Bay. The three individuals came within 3m of the boat's starboard stern into the illuminated halo provided by the vessel's deck lights. One individual spy-hopped for a few seconds before dropping back into the water, a second with a dorsal fin estimated to be about .75m tall, arched at the surface to breathe and then all three swam slowly towards Drake's Beach before turning towards the fish dock and lifeboat station in Drake's Bay. Different fishes and California sea lions (*Zalophus californianus*) had been observed in the vessel's lights during the cruise.

SCIENTIFIC PERSONNEL

<u>Name</u>	<u>Date On</u>	<u>Date Off</u>	<u>Position</u>	<u>Organization</u>
Dan Howard	9/22	10/3	Chief Scientist	CBNMS
Dale Roberts	9/22	10/3	Biologist	CBNMS
Michael Carver	9/22	10/3	Biologist	CBNMS
Mary Yoklavich	9/23	9/25	Biologist	NMFS
Linda Snook	9/23	9/25	Biologist	Consultant
Bob Lea	9/24	9/27	Biologist	CDF&G
Noelani Puniwai	9/26	10/3	Biologist	WSU
Tara Anderson	9/26	9/30	Biologist	NMFS
Tom Laidig	9/29	10/3	Biologist	NMFS

Key to Abbreviations:

CBNMS..... Cordell Bank National Marine Sanctuary

CDF&G.....California Department of Fish and Game

GFMNS.....Gulf of the Farallones National Marine Sanctuary

NMFS National Marine Fisheries Service

WSUWashington State University

DISPOSITION OF DATA:

Video tapes, still images, track line information, and physical data from the cruise are at the Cordell Bank NMS office, 1 Bear Valley Road, Point Reyes, CA.

References:

Stein, D.L., B.N. Tissot, M. A. Hixon, and W. Barrs. 1992. Fish-habitat associations on a deep reef at the edge of the Oregon continental shelf. *Fish. Bull., U.S.* 90:540-551.

Yoklavich, M.M., H.G. Greene, G.M. Cailliet, D.E. Sullivan, R.N. Lea, and M.S. Love. 2000. Habitat associations of deep-water rockfishes in a submarine canyon: an example of a natural refuge. *Fish. Bull., U.S.* 98:625-641.